

Method for 7.3 μm Water-Vapor Imaging of Granular Ground-Level Vapor Anomalies Which Mitigates Interference from Above Layers to Enable New Intelligence Insights Dependent Upon High-Contrast Imaging of Human-Introduced Moisture

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Introduction

Improving the contrast of water vapor imaging for useful resolution of subtle variations in water vapor near ground level is a prospect which has historically been hampered by the greater volume of water vapor in all above layers.

Unlike conventional photographic reconnaissance of objects on the ground, water vapor imaging is an effort to measure the concentration of moisture within a fluidic mixture of water and air near the bottom of an ocean of atmosphere. The only method thus far developed to enable even low-contrast imaging of ground-level water vapor relies upon the assumption that the upper levels of the atmosphere will deflect or absorb higher frequencies 8-12 μm . Indeed, this is the only reason why any water vapor imaging from the lower atmosphere is possible at any level of contrast. This level of contrast, however, is insufficient for intelligence purposes.

One needs to be able to differentiate between 7.3 μm emissions which originate from near ground-level and those which originate from above layers and to ignore light which comes from the above layers in order to create images of sufficient resolution and contrast to be useful for resolving anomalies of water vapor at ground level so as to augment the extant capability of infrared detection to assess human activities at ground level.

Abstract

In the case of orbital imaging, atmospheric scattering is generally thought of as something to be overcome. In the case of water vapor imaging near ground-level, the problem of scattering is further complicated by the fact that water vapor at ground-level is quite literally clouded by vapor in above layers of atmosphere. Rather than simply restricting observations to 7.3 μm , a more effective strategy for near-surface water-vapor imaging is called for.

That strategy consists of taking advantage of the entire water vapor band and filtering light from all water vapor bands according to its angular momentum in order to identify a value which may be termed Maximal Deviancy of Path in order to indirectly infer the distance traveled since emission.

When water vapor-associated microwave EM passes through the entire thickness of the atmosphere after emission from near the ground, it does not move in a

straight line but rather performs what statisticians refer to as a "drunk walk." When it arrives, some portion of it will strike a sensor head-on, but much of it will originate from an offset angle as result of essentially zig-zagging through the atmosphere. Much of the diffracted light is further scattered away from the sensor, but some small portion of that light will, perchance, make a series of leaps back through the atmosphere which cause it to arrive at the sensor after taking a less-direct route, not unlike the way that a Plinko chip will sometimes cover a great deal of horizontal space on the board despite the overall direction of momentum being in the vertical. All light traveling through atmosphere, like a Plinko chip, must zig-zag to at least some extent, but some waves of light will deviate more than others. Light which comes from ground level will always have a greater MDOP value than light which originates from a point closer to the sensor.

Although only a minority of the overall light associated with the mass of water vapor to be imaged will take the maximally circuitous route, the ability to filter light according to angular momentum and to algorithmically identify when identical frequencies from diametrically opposed but equal angles of attack strike the sensor in unison has utility for guiding the refinement of more traditional imagery. Light which has traveled through a lesser thickness of atmosphere will have a lesser MDOP. This understanding can pave the way for ground-level water-vapor associated microwave energy to be differentiated, if at mitigated resolution from mid- or upper-level-derived EM.

By measuring angular momentum and identifying temporally synchronous lightwaves striking a sensor from opposing angles at maximal deviancy, light can be binned as being necessarily originating from ground-level rather than coming from the middle or upper-atmosphere and this information can be used in order to guide multi-exposure algorithmic enhancement of more traditional 7.3 μm images.

This binning process enables the combination of a low-resolution, high-contrast image (the maximal-deviancy light-exclusive imaging) and a high-resolution, low-contrast image (the traditional 7.3 μm band imagery) in order to intelligently extract data from multiple exposures of conventional imagery in order to create an accurate, high-contrast, high-resolution meta-image accurately quantifying granular pockets of anomalous water vapor associated with human activity free from interference which would ordinarily confound attempts to create sufficiently granular water vapor imaging to support the intelligence application.

Conclusion

Although it is also possible to achieve a similar result by launching new clusters of orbital platforms with particular angles of offset appropriate for the application and using a combination of perspectives combined with algorithmic exclusion of light from the middle and upper atmosphere, the cost associated with launching entirely novel clusters of orbital platforms at the needed intervals (presently-deployed platform clusters are more closely conjoined than what is

called for to dither water vapor imaging between atmospheric layers) for the useful but ancillary application of ground-level water vapor imaging would not be cost-effective. In other words, it costs a lot less to make a better sensor mechanism than it does to hybridize multiple, costly platforms.

Light binning according to MDOP using sensors capable of measuring angular momentum and precision timing (very comparable to what is used in LiDAR imaging excepting the fact that LiDAR sensors lack in the needed angular momentum detection dimension required for this application) can enable a single platform to create high-resolution, high-contrast images of water vapor anomalies originating from near the surface of the Earth and which are associated with human activities. This capability may be enabled by either the (*ibid.*) previously promulgated transparent CMOS concept or by extant multi-layered gold-beryllium detectors capable of measuring differences in angular momentum in the microwave band.